CHROMOSOME NUMBERS OF CHAMAESARACHA (SOLANACEAE) IN TRANS-PECOS TEXAS AND ADJACENT REGIONS[1]

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The genus *Chamaesaracha* is comprised of 13 species, of which 5 occur in Asia, 1 in South America, and 7 in North America. According to Gould (1962) only 2 species, *C. coronopus* and *C. sordida*, inhabit Texas. However, *C. crenata* was reported by Rydberg (1896) to occur in Texas along the Rio Grande and New Mexico, and we have confirmed this (Table I). More recently, Scudday (1965) has verified the occurrence of another predominantly Mexican species, *C. villosa*, in west Texas.

The data presented here have originated both as a part of an overall project for reporting chromosome numbers of Trans-Pecos species, and from an earlier observation that populational entities of *Chamaesaracha* in this region exhibit considerable morphological variation. The junior author currently is pursuing a systematic study of the taxa in question using chromatographic as well as cytological data; therefore, answers to many questions raised here will be forthcoming.

METHODS AND TECHNIQUES

Buds were collected in the field and fixed in Modified Carnoy's Solution. Techniques for observation of meiotic chromosomes follow those outlined by Turner and Johnston (1961). Mitotic preparations were made according to methods employed by Turner and Fearing (1959). Staining of meiotic and mitotic chromosomes was accomplished with acetocarmine.

It should be noted that the most reliable counts were determined from anaphase I stages, or diads, because chromosomes were usually clumped and "sticky" at diakinesis and metaphase I in most *Chamaesaracha* individuals examined (Figs. 1, 3-7). Exceptionally, with chromosome numbers of $n = 12$, configurations were fairly clear at diakinesis and metaphase I. Meiosis was apparently regular in all plants (with one exception, see below), or at least there were an equal number of chromosomes segregating to each pole.

All chromosome numbers reported here are meiotic, with the exception of *Averett and Powell 65*, and *Averett 71* (Table I), but several polyploid individuals have been checked by mitotic examinations. So far seed germination of diploid plants ($n = 12$) has proved difficult.

Voucher specimens have been deposited in the herbaria at Sul Ross State College and The University of Texas, Austin.

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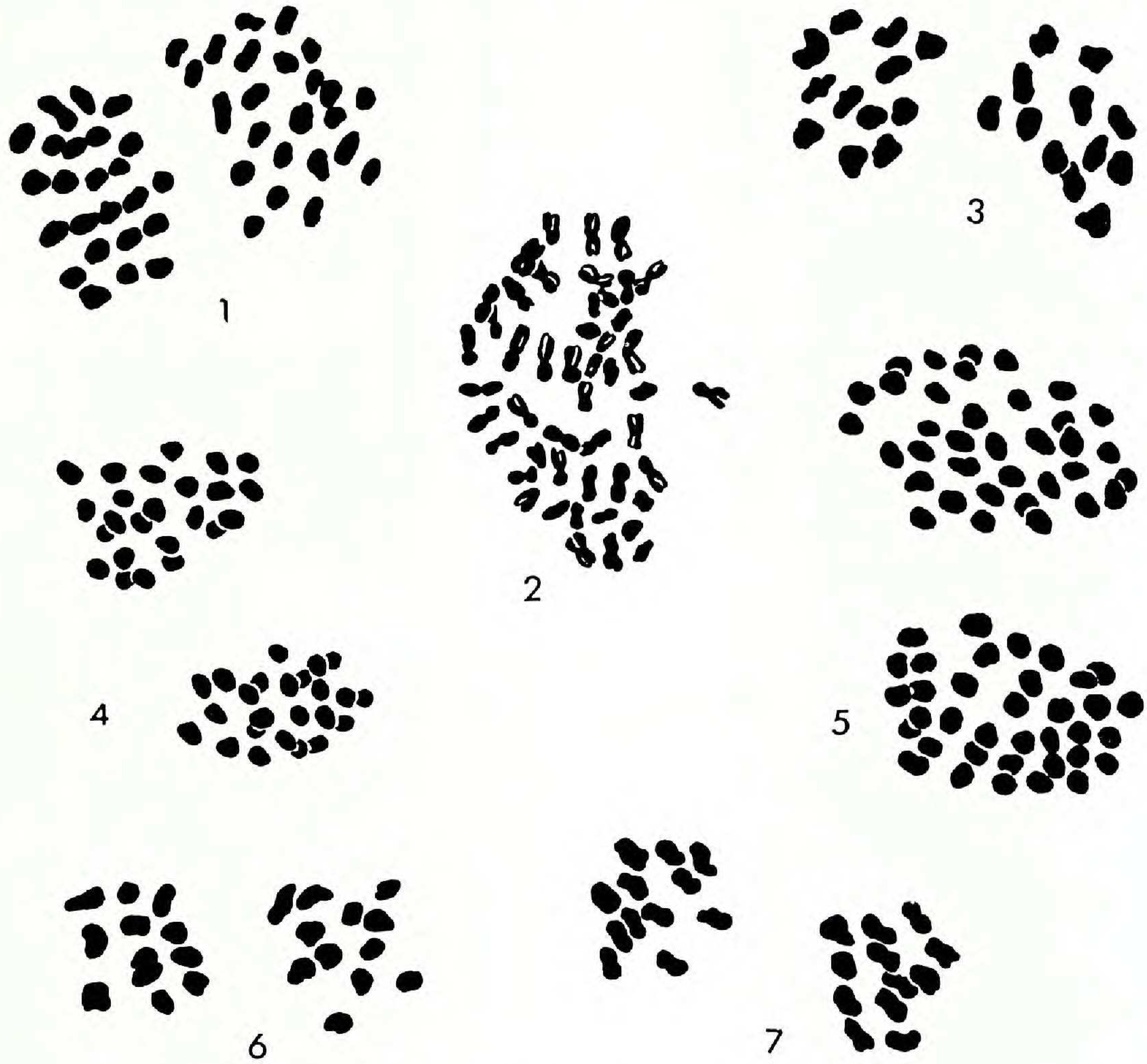

Figs. 1-7. Meiotic (anaphase I) and mitotic chromosomes of *Chamaesaracha* species, all X ca. 1300. Fig. 1. *C. coronopus (Sikes 61a; n = 24).* Fig. 2. *C. sordida (Averett 71; 2n = 48).* Fig. 3. C. cf. *sordida (Averett & Watson 162; n = 12).* Fig. 4. *C. sordida (Averett & Watson 161; n = 24).* Fig. 5. *C.* cf. *sordida (Averett 155; n = 36).* Fig. 6. *C. villosa (Sikes 59; n = 12).* Fig. 7. *C. crenata (Averett & Watson 66; n = 12.*

Table I. Species of *Chamaesaracha* examined for chromosome number.

Species	*n number*	*location and voucher*
C. coronopus	24	TEXAS: Brewster Co. Sul Ross Campus, Alpine. *Averett 69.*
	24	TEXAS: Brewster Co. Sul Ross Campus, Alpine. *Averett 132.*
	24	TEXAS: Brewster Co. Sul Ross Campus, Alpine. *Watson 48.*
	24	TEXAS: Culberson Co. 42 mi n. of Van Horn. *Sikes 75.*

	24a	TEXAS: El Paso Co. 1 mi. e. of Franklin Mts. *Sikes 61a, b.*
	24	TEXAS: Jeff Davis Co. 1 mi s.w. of Ft. Davis. *Averett 98.*
	24	TEXAS: Presidio Co. 4 mi. s. of Marfa. *Averett & Sikes 128.*
	24	TEXAS: Presidio Co. 15 mi. s. of Marfa. *Averett 77.*
C. sordida	24a, b	TEXAS: Brewster Co. Sul Ross Campus. *Averett 71.*
	24	TEXAS: Brewster Co. 6 mi s. of Alpine. *Averett 125.*
	24	TEXAS: Brewster Co. 16 mi e. of Alpine. *Averett 83.*
C. sordida	24	TEXAS: Brewster Co. 6 mi w. of Alpine. *Averett & Sikes 130.*
	24	TEXAS: Brewster Co. 20 mi s. of Alpine. *Averett & Johnson 108.*
	ca. 24	TEXAS: Brewster Co. 6 mi n. of Alpine, *Averett 133.*
	24a	TEXAS: Brewster Co. 12 mi e. of Alpine. *Averett & Watson 161.*
	24	TEXAS: Jeff Davis Co. 16 mi n. of Alpine. *Sikes 5.*
	24	TEXAS: Jeff Davis Co. 6 mi s.e. of Ft. Davis. *Averett 75.*
	24	TEXAS: Jeff Davis Co. 4 mi s. of Ft. Davis. *Averett 135.*
	24	TEXAS: Jeff Davis Co. 1 mi w. of Ft. Davis. *Averett 136.*
	24	TEXAS: Presidio Co. 16 mi s. of Marfa, *Averett 79.*
	24	TEXAS: Presidio Co. 4 mi s. of Marfa. *Averett & Sikes 128.*
	24	TEXAS: Presidio Co. 20 mi n. of Shafter. *Averett 72.*
	24	TEXAS: Presidio Co. Casa Piedra road, 11 mi s. of Marfa. *Averett 149.*
	24	MEXICO: Coahuila. Sierra del Burro Pass. *Powell 1441.*
	24	MEXICO: Coahuila. 24 mi w. of Cd. Acuña. *Powell 1412.*

a Denotes chromosome drawing.

b Derived from root tip cells.

C. cf. sordida	12	TEXAS: Brewster Co. 1 mi w. of Alpine. *Averett & Johnson 114.*
	12	TEXAS: Brewster Co. 5 mi s. of Marathon. *Averett 76.*
	12	TEXAS: Brewster Co. 42 mi e. of Alpine. *Averett 82.*
	12	TEXAS: Brewster Co. 1 mi s. of Alpine. *Averett 112.*
	12a	TEXAS: Brewster Co. Marathon e. city limits. *Averett & Watson 162.*
	12	TEXAS: Brewster Co. Sul Ross Campus, Alpine. *Averett 231.*
	12	TEXAS: Crane Co. 6 mi n. of Imperial. *Averett 80.*
	12	TEXAS: Presidio Co. 35 m s.w. of Marfa. *Averett 153.*
	12	NEW MEX: Chaves Co. 50 mi s. e. of Cloudcroft. *Sikes 72.*
	12	NEW MEX: Chaves Co. 43 mi s. e. of Cloudcroft. *Sikes 70a.*
	12	NEW MEX: Dona Ana Co. 5 mi e. of Las Cruces. *Sikes 66.*
	12	NEW MEX: Dona Ana Co. Foothills on w. side of Organ Mts. *Sikes 63b.*
	12	MEXICO: Chihuahua. 17 km. w. of Sueco. *Powell 1341.*
C. cf. sordida	18	TEXAS: Culberson Co. 21 mi s.w. of Whites City, New Mex. *Sikes 74.*
C. cf. sordida	24	TEXAS: Brewster Co. 25 mi s. of Marathon. *Averett & Watson 163.*
	24	TEXAS: Val Verde Co. 2.5 mi e. of Langtry. *Averett & Watson 86.*
	24	TEXAS: Val Verde Co. 7 mi e. of Langtry. *Averett & Watson 87.*
	24b	TEXAS: Val Verde Co. 8 mi w. of Comstock. *Averett & Powell 65.*
C. cf. sordida	36	TEXAS: Brewster Co. 4 mi n. of Black Gap Hdqs. *Averett & Watson 178.*
	36	TEXAS: Brewster Co. n. e. entrance to Big Bend Nat'l. Park. *Averett & Watson 169.*
	36	TEXAS: Brewster Co. Black Gap road, 9 mi s. e. of US 385. *Averett & Watson 168.*

	36	TEXAS: Pecos Co. 3 mi s. of Imperial. *Averett 182.*
	36	TEXAS: Pecos Co. 5 mi s. of Imperial. *Averett 183b.*
	ca. 36	TEXAS: Pecos Co. 5 mi s. of Imperial. *Averett 183a.*
	36a	TEXAS: Presidio Co. 35 mi s. w. of Marfa. *Averett 155.*
C. villosa	12a	TEXAS: Culberson Co. 4 mi w. of Van Horn. *Sikes 59.*
	12	TEXAS: Hudspeth Co. 20 mi s. of Sierra Blanca. *Averett & Powell 184.*
C. villosa	12	TEXAS: Presidio Co. 3 mi e. of Ruidosa. *Averett 156.*
	ca. 12	TEXAS: Presidio Co. 3 mi n. w. of Presidio. *Averett 157.*
	12	TEXAS: Presidio Co. 3 mi e. of Ruidosa. *Brey & Powell 61.*
	12	TEXAS: Presidio Co. 14.6 mi s. e. of Ruidosa. *Sikes & Averett 135.*
	12	TEXAS: Presidio Co. 6.8 mi n. w. of Presidio. *Sikes & Averett 141.*
C. crenata	12	TEXAS: Brewster Co. 0.4 mi n. of Black Gap Hdqs. *Averett & Watson 164.*
	12	TEXAS: Presidio Co. 15 mi w. of Lajitas. *Averett 73.*
	12a	TEXAS: Presidio Co. 12 mi w. of Lajitas. *Averett & Watson 66.*
C. cf. crenata	12	TEXAS: Brewster Co. 5 mi n. of Big Bend Nat'l. Park Hdqs. *Averett & Powell 139.*
	12	TEXAS: Brewster Co. 0.4 mi n. of Black Gap Hdqs. *Averett & Watson 166.*
	12	TEXAS: Brewster Co. Head of Boquillos Canyon, Big Bend Nat'l. Park. *Averett & Watson 173.*

DISCUSSION

The only previous chromosome number reported for *Chamaesaracha* has been $n = 12$ for *C. nana* (Raven, 1959). Information given below suggests that cytological data will be of value in understanding the taxonomy of the genus.

Undoubtedly the reader will notice the many tentative identifications (Table I), particularly in reference to *Chamaesaracha sordida*. Actually *C. coronopus* is the only species which seems to exhibit relatively uniform and readily understandable variation, at least in Trans-Pecos Texas.

For the purposes of this report, those collections which are comparable to the type specimen are listed as *Chamaesaracha sordida*. These are believed to be individuals which have chromosome numbers of $n = 24$, mainly because like the type they have leaves which are deeply lobed. Other collections tentatively identified as *C. sordida* have chromosome numbers of $n = 12$, $n = 36$, $n = 18$, and in some cases $n = 24$. Plants of the latter group ($n = 12, 36, 18, 24$) exhibit morphological variation different from that previously understood to typify *C. sordida* (as measured by descriptions and the type).

We also report chromosome numbers of *Chamaesaracha villosa* and *C. crenata*, two species primarily of Mexican distribution in the Chihuahuan desert, both with $n = 12$. Where these compare favorably with the type specimens and original description, they are listed accordingly. Few of our Trans-Pecos collections, however, compare exactly with the type of *C. crenata*, and consequently we have given these only tentative identifications in Table I. It will be necessary to study the Mexican populations of both of these taxa before reliable taxonomic conclusions can be reached.

Chromosome numbers have been obtained from as many as 5 individuals in several populations, while in other cases, only one or a few individual plants were sampled. In every instance the same chromosome number has been found to occur in all individuals of each particular population. Additionally, no morphological or chromosomal entities have been found to occur sympatrically, or at least together in the same population, with the exception that *C. coronopus* and *C.* cf. *sordida* ($n = 12$, and $2n = 48$) occur together on the Sul Ross Campus in Alpine, Texas. Even in this locality there are small clusters of 10 to 20 plants of the same kind, but the species are not intermixed populationally speaking. Also, *C. coronopus* may occur in the same general area with other taxa in the Trans-Pecos (viz., *C.* cf. *sordida*, *C.* cf. *villosa*, *C.* cf. *crenata*), but this species has not been observed growing side by side with any of the others.

As indicated above, populations with differing chromosome numbers generally exhibit morphological features, especially habit, leaf shape, and pubescence, which are distinguishing. Considerable field observations have shown that the variation is not clinal in nature. Whether or not the varying morphology is due to environmental influences, pockets of relatively minor genetic differences, or both, is not clear at this time. Interestingly enough, preliminary 2-dimensional paper chromatographic examinations for phenolic compounds have shown consistent patterns which correspond positively with the different cytological and morphological entities. Chemical investigations of the genus will be extended yet further, along with more detailed populational analysis.

A great deal of consideration has been given to the possibility that hybridization is occurring between the Trans-Pecos taxa of *Chamaesaracha*. Particularly notable cytological evidence to this effect is brought out with the discovery of a chromosome number of $n = 18$ in one plant (Table I). The meiotic behavior of chromosomes observed in this collection was indicative of well known phenomena associated with hybridization. The number, $n = 18$, was observed in about 100 cells, but in an almost equal number of cells, up to 22 chromosomes could be seen. Further examination showed that chromosomes were not segregating equally at anaphase I. As indicated above, diakinetic and metaphase behavior is difficult to study in *Chamaesaracha*, but it appeared as though normal pairing was not occurring consistently. Unfortunately, the specimen was taken in the process of regional sampling, and no populational data are available. However, if the plant is a hybrid, exomorphic features suggest that only *C.* cf. *sordida* parentage was involved (i.e., $n = 12 \times n = 24$), even though *C. coronopus* is known to occur in the general vicinity (Table I).

The morphic features of the *Chamaesaracha* taxa in question, so far as has been determined, do not serve as "good" markers or indicators of hybridization. Nevertheless, the problem is being approached experimentally (hybridization studies), and chromatographically, and we are hopeful that the origin of at least some of the polyploid populations in the Trans-Pecos can be elucidated.

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